PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-222009
(43)Date of publication of application : 26.08.1997

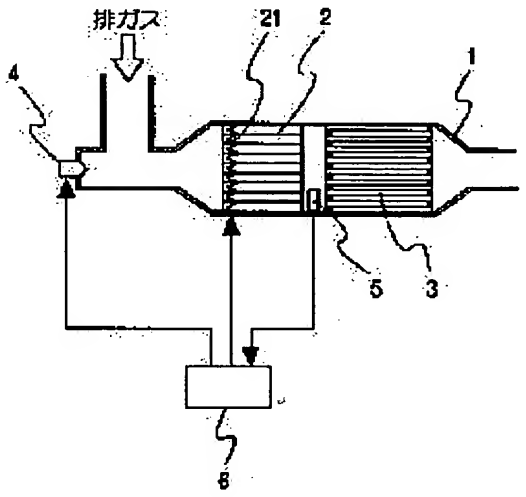
(51)Int.Cl. F01N 3/02
F01N 3/02
F01N 3/20
F02D 43/00

(21)Application number : 08-053913
(22)Date of filing : 15.02.1996

(71)Applicant : NIPPON SOKEN INC
(72)Inventor : KOI RYOJI
MIYOSHI SHINJI
TAKAGI JIRO

(54) EXHAUST PARTICULATE PURIFYING DEVICE FOR INTERNAL COMBUSTION ENGINE

(57)Abstract:
PROBLEM TO BE SOLVED: To perform the excellent regeneration of a filter without needing a long time for regeneration and the increase of an amount of a feed power even on an operation condition that an exhaust gas temperature is especially low during idling.
SOLUTION: A catalyst converter 2 is arranged upper stream of a flow of exhaust gas from a catalyst carrier filter 3 arranged in the middle of the exhaust gas flow passage of the internal combustion engine and collecting fine particles contained in exhaust gas. A partial heating heater 21 to electrically generate heat and partially activate the catalyst of a catalyst converter 2 is mounted on the catalyst converter 2. When the filter 3 is regenerated on an operation condition having an exhaust gas temperature lower than a catalyst activated temperature, the partial heating heater 21 is energized to partially activate a catalyst converter 2. Further, unburnt fuel is fed in an exhaust flow passage 1, situated upper stream from the catalyst converter, by a fuel injection valve 4 and oxidized by an activated catalyst. Since a fuel feed amount is controlled to a small amount enough to allow maintenance of an activating state by the activated catalyst until the active state of the catalyst is stabilized, a device temperature is not lowered and thereafter through the increase of a fuel feed amount, an activated region is enlarged to a whole.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The catalyst support filter which carries out uptake of the particle which is prepared in the middle of an internal combustion engine's exhaust air passage, and is contained during exhaust air, The catalytic converter formed in the upstream of the above-mentioned filter to the flow of exhaust air of an internal combustion engine, The partial heating heater which generates heat electrically [when it is attached to this catalytic converter and an exhaust-gas temperature reproduces a filter by the service condition lower than catalytic activity-ized temperature], and can activate the catalyst of the above-mentioned catalytic converter partially, A fuel-supply means to supply a non-burned fuel all over the exhaust air passage of the upstream from the above-mentioned catalytic converter, Based on the catalytic activity condition of the above-mentioned catalytic converter, the catalyst which activated the fuel amount of supply until the active state of a catalyst was stabilized presupposes that extent which can maintain an active state is little. Then, the exhaust air particle purge of the internal combustion engine characterized by providing the control means controlled to make the fuel amount of supply increase.
[Claim 2] The exhaust air particle purge of the internal combustion engine according to claim 1 which computed time amount until the fuel amount of supply and the active state to which a means to detect an exhaust-gas temperature is formed in the downstream of the above-mentioned catalytic converter or a catalyst support filter, and the catalyst of the above-mentioned catalytic converter can maintain [the above-mentioned control means] an active state based on the detection result are stabilized.
[Claim 3] The exhaust air particle purge of the internal combustion engine according to claim 2 which is the thing to which the fuel amount of supply is made to increase from the time of the above-mentioned control means judging whether the active state of a catalyst was stabilized by whether for the exhaust-gas temperature detected with the above-mentioned detection means to have risen, and to have been stabilized, and the rise of an exhaust-gas temperature being stabilized.
[Claim 4] Claim 1 which has sufficient die length for the catalyst support part of the above-mentioned catalytic converter to burn the total fuel supplied thru/or the exhaust air particle purge of an internal combustion engine given in three.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a means to carry out combustion removal of the particle which carried out uptake especially about the exhaust air particle purge of internal combustion engines which do uptake of the particle contained during an internal combustion engine's exhaust air to a filter, and purify exhaust air, such as a diesel power plant, and to reproduce a filter.
[0002]
[Description of the Prior Art] While inflammable particles, such as a carbon particle, are contained during the exhaust air discharged by internal combustion engines, such as a diesel power plant, uptake of this is carried out to a filter and exhaust air is purified, carrying out combustion removal of the particle which carried out uptake periodically, and reproducing a filter is performed. A fuel is supplied to a filter and the approach of heating the particle which carried out uptake with the oxidation heat of reaction of a fuel, and burning is learned at the same time it makes the filter support an oxidation catalyst and raises whenever [catalyst temperature] with hot exhaust air as a playback means of this filter more than activation temperature, for example.
[0003] However, by the above-mentioned approach, it is difficult like [at the time of an internal combustion engine's low rotation and low load driving] to carry out the temperature rise of the catalyst in a service condition with a low exhaust-gas temperature more than activation temperature. For this reason, since the catalyst is not being activated even if it supplies a fuel, heating combustion of the particle to which the fuel caused and carried out uptake of the oxidation reaction cannot be carried out. Consequently, the filter started blinding, exhaust gas pressure increased, and there was concern to which an internal combustion engine's engine performance is reduced.
[0004] On the other hand, previously, this invention person etc. proposed the exhaust air particle purge which formed the partial heating heater 2 for heating a surrounding catalyst partially in the upstream of the catalyst support filter 3 prepared in the middle of exhaust air passage 1, as shown in drawing 6 (Japanese Patent Application No. No. 176684 [six to]). It constitutes and the partial heating heater 2 becomes so that it may generate heat electrically in a part of catalyst support of for example, a metal honeycomb mold, can heat a catalyst partially by energization and can be activated.
[0005] In the above-mentioned configuration, when an exhaust-gas temperature reproduces a filter by the service condition lower than catalytic activity-ized temperature, first, power is supplied to the partial heating heater 2, and a part of catalyst is activated (drawing 6 , 7 reference). And from the fuel injection valve 4 prepared in exhaust air passage 1 wall which counters the partial heating heater 2, a little fuel tends to be injected, the fuel amount of supply

tends to be increased gradually after that, the whole catalyst of a filter 3 tends to be activated with the oxidation heat of reaction of a fuel, and it is going to enable playback of the filter 3 at the time of low rotation and low load driving in the beginning.
[0006]
[Problem(s) to be Solved by the Invention] However, by the above-mentioned playback approach, if exhaust-gas temperatures, such as the time of an idling, do not lessen the fuel amount of supply enough in a low service condition especially, there is a problem that playback of a filter cannot be performed. The fuel amount of supply required if this has a low exhaust-gas temperature, in order to carry out the temperature up of this increases, it is because the part latent heat of vaporization also becomes large, and a heating value required for the wall surface temperature of the partial heating heater 2 to fall, and activate a catalyst is not obtained, but it becomes difficult to reproduce a filter (shown in drawing 8 as (a)).
[0007] Then, although the fuel amount of supply is lessened enough, and it must consider as a setup to which it is made to increase slowly enough also when making the amount of supply increase further so that the wall surface temperature of the partial heating heater 2 may not fall (drawing 8 (b)), playback takes long time amount and it is not practical. In order to avoid this, it is necessary to increase the power supply to the partial heating heater 2, and a problem is in economical efficiency.
[0008] Carrying out a deer, this invention has the time of an idling etc. in offering the exhaust air particle purge of the internal combustion engine which can reproduce a filter good, without playback taking a long time or an exhaust-gas temperature increasing a power supply also in an especially low service condition.
[0009]
[Means for Solving the Problem] In the configuration of claim 1 an internal combustion engine's particle purge The catalyst support filter which carries out uptake of the particle which is prepared in the middle of an internal combustion engine's exhaust air passage, and is contained during exhaust air, It has a catalytic converter in the upstream to the flow of exhaust air, and when reproducing a filter to this catalytic converter by the service condition with an exhaust-gas temperature lower than catalytic activity-ized temperature, the partial heating heater which generates heat electrically and can activate the catalyst of the above-mentioned catalytic converter partially is attached. Moreover, a purge is equipped with a fuel-supply means supply the fuel which is not burned in the inside of the exhaust air passage of the upstream from the above-mentioned catalytic converter, and the control means of the fuel amount of supply, and a control means is made little [extent to which the catalyst which activated the fuel amount of supply based on the catalytic-activity condition of the above-mentioned catalytic converter until the active state of a catalyst was stabilized can maintain an active state], and it has made as [control / to make the fuel amount of supply increase after that] (claim 1).
[0010] The particle deposited on the filter with the oxidation heat of reaction in order that a fuel might oxidize according to a catalyst, if the fuel which is not burned in the inside of exhaust air passage with a fuel-supply means when an exhaust-gas temperature is beyond catalytic activity-ized temperature like [in case playback of a filter has an internal combustion engine in the service condition of high rotation and a heavy load] was supplied can be heated, and it can be made to burn. However, since the catalyst is not being activated like [in case an internal combustion engine is in low rotation and the service condition of a low load] even if it supplies a fuel when an exhaust-gas temperature is lower than catalytic activity-ized temperature, a fuel does not oxidize and playback of a filter cannot be performed.
[0011] When such, with the configuration of this invention claim 1, power is supplied to the partial heating heater attached to the catalytic converter of the catalyst support filter upstream, the catalyst near the heater is heated, and the catalyst of a catalytic converter is activated partially. In the place by which the temperature of a partial heating heater was stabilized, with a fuel-supply means, if whenever [near the heater / catalyst temperature] supplies a fuel with extent more nearly little than activation temperature which does not become low, it will oxidize with the catalyst which the fuel activated partially, and a catalytic activity-ized field will spread gradually in response to the heat of reaction. Here, without reducing the wall surface

temperature of a partial heating heater, since the catalyst activated once is controlled by the small quantity of extent which can maintain an active state, the fuel amount of supply can extend an activation field gradually, and can expand it from a catalytic converter to some filters.
[0012] In the place by which the active state of a catalyst was stabilized, if the fuel amount of supply is made to increase, a fuel will oxidize in the spreading catalytic activity-ized field, a catalytic activity-ized field will spread further in response to the heat of reaction, and, finally the catalyst of the whole filter will be activated. A fuel oxidizes with the catalyst of a catalytic converter and the whole filter, carries out the temperature up of the particle deposited on the filter with this heat of reaction more than ignition temperature, burns it, and can reproduce a filter.
[0013] What is necessary is to more specifically form a means to detect an exhaust-gas temperature in the downstream of the above-mentioned catalytic converter or a catalyst support filter, and just to constitute so that time amount until the fuel amount of supply and the active state to which the catalyst of a catalytic converter can maintain [the above-mentioned control means] an active state based on the detection result are stabilized may be computed (claim 2).
[0014] Furthermore, the above-mentioned control means judges whether the active state of a catalyst was stabilized by whether for the exhaust-gas temperature detected with the above-mentioned detection means to have risen, and to have been stabilized, and if it sets up so that the fuel amount of supply may be made to increase from the time of the rise of an exhaust-gas temperature being stabilized (claim 3), fuel-supply time amount until the active state of a catalyst is stabilized can be made into more suitable die length.
[0015] Moreover, a catalyst support part can also consider the above-mentioned catalytic converter as the configuration which has sufficient die length to burn the total fuel supplied (claim 4). Since all the fuels supplied burn within a catalytic converter at this time, the temperature gradient in catalyst support filter order can be made small. There is an advantage which can compare with the configuration which burns a fuel within a filter by this, and can reduce and prevent the cinder of a particle, and can prevent the filter damage by the abnormality elevated temperature in filter back etc.
[0016]
[Embodiment of the Invention] Hereafter, the gestalt of 1 operation of this invention is explained with reference to a drawing. In drawing 1 , an internal combustion engine's exhaust air passage 1 has prepared the major diameter on the way, and to the flow of exhaust air, a catalytic converter 2 and the catalyst support filter 3 set spacing, and are arranged from the upstream in this major diameter.
[0017] It makes it come, after the above-mentioned catalyst support filter 3 consisted of porosity ceramics, such as cordierite, and coating this with gamma-alumina etc. to support oxidation catalysts, such as Pt or Pd-Rh. This filter 3 has many cels in the flow direction of exhaust air, and has made them with the structure which closed the edge of either the exhaust gas installation side of each [these] cel, or a derivation side in the shape of a hound's-tooth check. And while the introduced exhaust gas circulates between each cel through a porous septum, uptake of the particles, such as a carbon particle, is carried out.
[0018] After carrying out the laminating of the band-like plate and band-like corrugated plate which consist of heat-resistant metallic foils, such as stainless steel, and coating with gamma-alumina etc. the metal support of the honeycomb structure which it comes to twist around the circumference of a rod-like center electrode at a curled form, the above-mentioned catalytic converter 2 makes oxidation catalysts, such as Pt or Pd-Rh, support, and is constituted.
[0019] The above-mentioned catalytic converter 2 has the partial heating heater 21 for generating heat by energization at the upstream edge, and activating a catalyst partially at it. The above-mentioned catalytic converter 2 the plate and corrugated plate which constitute metal support For example, the junction field it was made to short-circuit between the layers joined, rolled and piled up by soldering etc., Mutually, a plate and a corrugated plate are rolled, as an insulation is held, a current consists of a non-joining field it was made to flow to a curled form, among these in a junction field, since a current connects too hastily and flows, electric

resistance is small and produces generation of heat intensively in the non-joining field where electric resistance is large. Therefore, if the above-mentioned metal support is formed so that the part which forms the partial heating heater 21 may serve as a non-joining field, by being able to form the partial heating heater 21 easily in some catalytic converters 2, and energizing between the annular electrodes of a periphery from a center electrode, the partial heating heater 21 can generate heat, a surrounding catalyst can be heated, and it can be activated.
[0020] Here, it is not necessary to form the partial heating heater 21 all over the upstream end face of the above-mentioned catalytic converter 2, it may be installed in the part, for example, the whole, punctate, can activate the catalyst of the circumference of it partially with little power, and can oxidize a fuel at an early stage.
[0021] Moreover, as support of the above-mentioned catalytic converter 2, using the ceramic support which fabricated porosity ceramics, such as cordierite, in the shape of a honeycomb, the suitable part of the upstream edge can be made to be able to carry out fixed support of the kanthal line etc., and the above-mentioned partial heating heater 21 can also be formed in it.
[0022] From the above-mentioned catalytic converter 2, further, you make it the exhaust air passage 1 of the upstream crooked at the right angle, and the fuel-supply means slack fuel injection valve 4 is formed in exhaust air passage 1 wall of the above-mentioned right-angle section which counters the above-mentioned partial heating heater 21. This fuel injection valve 4 is connected to the fuel-supply system of ****. Moreover, between the above-mentioned catalytic converter 2 and the above-mentioned catalyst support filter 3, the temperature sensor 5 which consists of a thermistor etc. is installed, and it enables it to have measured the exhaust-gas temperature after the above-mentioned catalytic-converter 2 passage. In addition, it is good also as a configuration which installs a temperature sensor 5 in the downstream of the above-mentioned catalyst support filter 3.
[0023] It connects with the control means slack controller 6, and the above-mentioned partial heating heater 21, a fuel injection valve 4, and a temperature sensor 5 enable it to have controlled the energization to the partial heating heater 21, and supply of the fuel by the fuel injection valve 4 based on the exhaust-gas temperature measured with a temperature sensor 5.
[0024] The control approach of the fuel amount of supply in the particle purge of the above-mentioned configuration is shown in drawing 2 . If it judges that an exhaust-gas temperature is lower than catalytic activity-ized temperature from the measurement result of the above-mentioned temperature sensor 5 at the time of playback initiation of a filter, with the signal from a controller 6, power will be supplied to the above-mentioned partial heating heater 21, and the catalyst supported by the above-mentioned catalytic converter 2 will be activated partially (drawing 2 (a)).
[0025] Next, a controller 6 computes the fuel amount of supply F which does not benefit the latent heat of vaporization of the fuel which the wall surface temperature of the catalytic activity-ized field of a catalytic converter 2 supplied below catalytic activity-ized temperature from an exhaust air flow rate or an engine speed, and an exhaust-gas temperature. And only the time amount Ts on which it was able to decide beforehand supplies the fuel of this fuel amount of supply F in the exhaust air passage 1 from a fuel injection valve 4. It is made for the fuel-supply time amount Ts to turn into beyond time amount until the temperature of a catalytic converter 2 is risen and stabilized here with the heat of reaction which the fuel of the fuel amount of supply F burned and generates.
[0026] Since the temperature is maintainable beyond catalytic activity-ized temperature even if it supplies much more fuels after the temperature of a catalytic converter 2 is stabilized, the fuel amount of supply is made to increase gradually after that. This expands a catalytic activity-ized field to the whole catalytic converter 2 and some filters 3 (drawing 2 R> 2 (b)). And if the fuel amount of supply is made to increase further at a rate that extent which can maintain catalytic activity-ized temperature was decided beforehand, a catalytic activity-ized field is expandable to most of catalytic converters 2 and filters 3 (drawing 2 (c)).
[0027] up to the amount which can carry out the temperature up of the fuel amount of supply to the combustion temperature of an exhaust air particle after this -- till then -- ** -- it comes out comparatively, and whether it increases or increases immediately, there is no same thing it is

[the thing] less than catalytic activity-ized temperature. And the fuel supplied oxidizes within a catalytic converter 2 and a filter 3, carries out the exhaust air particle deposited on a filter 3 with this heat of reaction more than ignition temperature, burns it, and can reproduce a filter.
[0028] The control approach of the fuel amount of supply in the gestalt of the operation of the 2nd of this invention to drawing 3 is shown. With the gestalt of this operation, control of the supply time amount of the fuel amount of supply F by the controller 6 is performed in the equipment configuration of above-mentioned drawing 1 using the output of the temperature sensor 5 installed in the lower stream of a river of a catalytic converter 2.
[0029] That is, although the catalytic activity-ized field spreads by fuel supply after starting the fuel supply of the fuel amount of supply F like the gestalt of implementation of the above 1st (drawing 3 (a)), it presumes whether the temperature of a catalytic converter 2 was stabilized here by whether the output of a temperature sensor 5 was risen and stabilized. And when judging that the temperature of a catalytic converter 2 was stabilized by expansion of stability, i.e., a catalytic activity-ized field, the fuel amount of supply is made to increase from the time further. Henceforth, a filter is reproduced like the gestalt of implementation of the above 1st (drawing 3 (b), (c)).
[0030] Thus, by controlling, fuel-supply time amount t until it stabilizes the temperature of a catalytic converter 2 further rather than the gestalt of implementation of the above 1st is made to suitable die length, and there is an advantage that supplying long time amount and a fuel vainly is lost.
[0031] The configuration of the particle purge in the gestalt of the operation of the 3rd of this invention to drawing 4 is shown. With the gestalt of this operation, the die length of the catalytic converter 2 which has the partial heating heater 21 was shortened very much, the catalytic converter 7 which has sufficient die length to burn total fuel in the fuel scope of supply is formed in that lower stream of a river, and it has made as [carry out / within this catalytic converter 7 / mainly / the temperature up of exhaust air]. In addition, it is not necessary to necessarily use the above-mentioned catalytic converter 2 and a catalytic converter 7 as another object, and they may be constituted so that the catalyst support section of a catalytic converter 2 may serve as required sufficient die length.
[0032] Also in such a configuration, the control of the fuel amount of supply based on the active state of a catalytic converter is effective, and the control approach of the fuel amount of supply is shown in drawing 5 . In the above-mentioned configuration, if it judges that an exhaust-gas temperature is lower than catalytic activity-ized temperature with a temperature sensor 5 at the time of playback initiation of a filter 3, power will be supplied to the above-mentioned partial heating heater 21 with the signal from a controller 6, and the catalyst supported will be activated partially.
[0033] Next, from an exhaust air flow rate or an engine speed, and an exhaust-gas temperature, a controller 6 computes the fuel amount of supply F which the wall surface temperature of the catalytic activity-ized field of a catalytic converter 2 does not become below catalytic activity-ized temperature for the latent heat of vaporization of the supplied fuel, and starts fuel supply (drawing 5 (a)). And only the time amount Ts which was able to determine beforehand the fuel of this fuel amount of supply F is supplied from a fuel supply system. The temperature of a catalytic converter 2 rises by this, and even if it supplies much more fuels, as for the temperature of a catalytic converter 2, beyond catalytic activity-ized temperature can be maintained.
[0034] Then, if the fuel amount of supply is made to increase with the inclination decided beforehand gradually, the catalyst of a catalytic converter 7 is activated, a catalytic activity-ized field spreads with the increment in the fuel amount of supply (drawing 5 (b)), and, finally the catalyst of the catalytic-converter 7 whole can be activated (drawing 5 (c)). Henceforth, if the fuel amount of supply is made to increase to the combustion temperature of an exhaust air particle immediately further to the same rate even as it, or the amount which can carry out a temperature up, a fuel oxidizes within a catalytic converter 7, the temperature up of the exhaust-gas temperature which flows into a filter with the heat of reaction is carried out more than the combustion temperature of soot, and a filter can be reproduced.

[0035] Since the catalytic converter 7 which has die length sufficient with the above-mentioned configuration to burn total fuel is formed and it was mainly made to carry out the temperature up of exhaust air within this catalytic converter 7, the temperature gradient in catalyst support filter order can be made small. There is an advantage which can compare with the configuration which burns a fuel within a filter by this, and can reduce and prevent the cinder of a particle, and can prevent the filter damage by the abnormality elevated temperature in filter back etc.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the whole exhaust air particle purge outline sectional view showing the gestalt of operation of the 1st of this invention.
[Drawing 2] It is drawing for explaining the control approach of the fuel amount of supply in the gestalt of the 1st operation.
[Drawing 3] It is drawing for explaining the control approach of the fuel amount of supply in the gestalt of operation of the 2nd of this invention.
[Drawing 4] It is the whole exhaust air particle purge outline sectional view showing the gestalt of operation of the 3rd of this invention.
[Drawing 5] It is drawing for explaining the control approach of the fuel amount of supply in the gestalt of the 3rd operation.
[Drawing 6] It is the conventional whole exhaust air particle purge outline sectional view.
[Drawing 7] It is drawing for explaining the control approach of the conventional fuel amount of supply.
[Drawing 8] It is drawing showing the fuel amount of supply in the conventional fuel amount-of-supply control, and the relation of time amount.
[Description of Notations]
1 Exhaust Air Passage
2 Catalytic Converter
21 Partial Heating Heater
3 Catalyst Support Filter
4 Fuel Injection Valve (Fuel-Supply Means)
5 Temperature Sensor (Detection Means)
6 Controller
7 Catalytic Converter

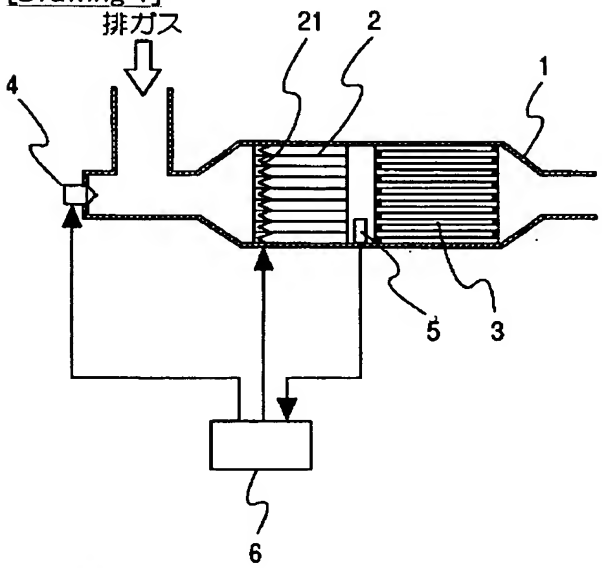
[Translation done.]

* NOTICES *

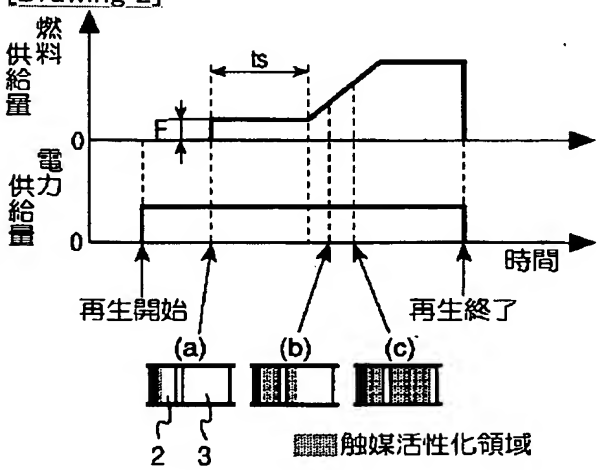
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

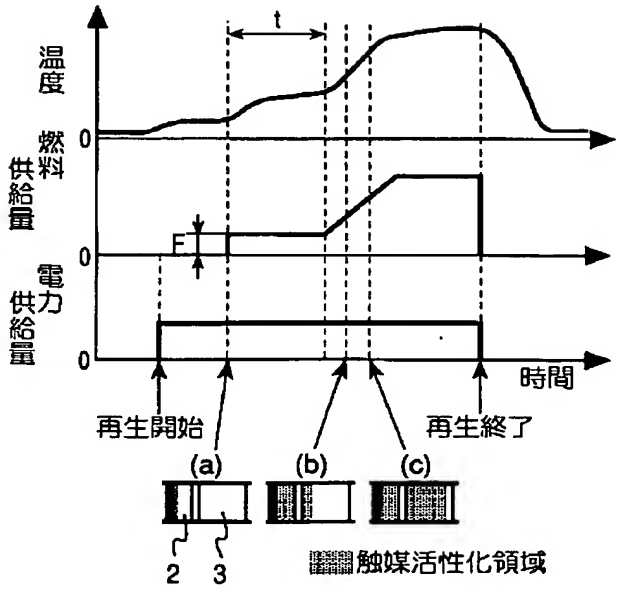
[Drawing 1]



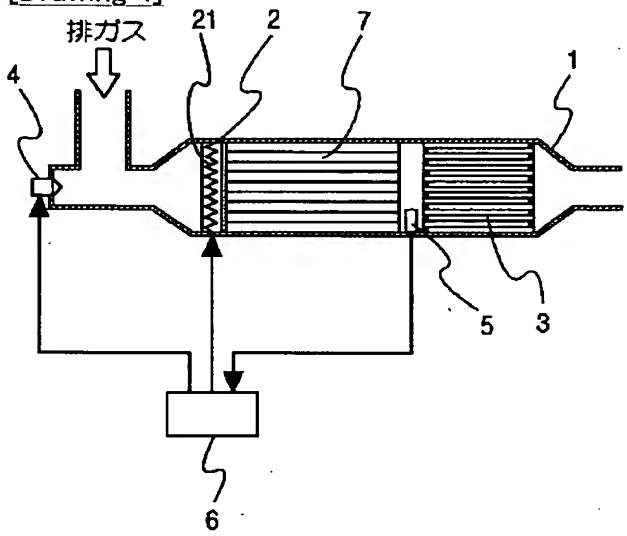
[Drawing 2]



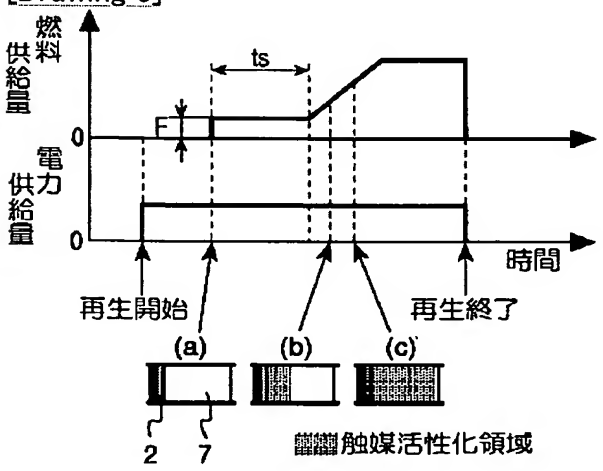
[Drawing 3]



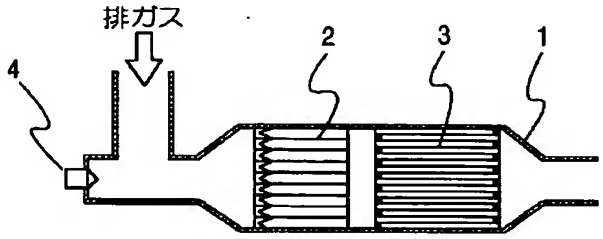
[Drawing 4]



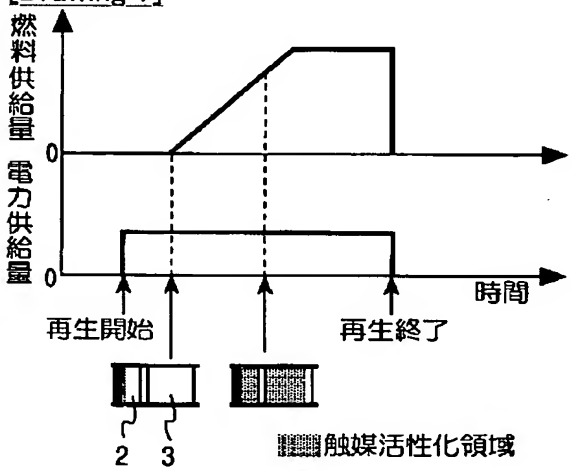
[Drawing 5]



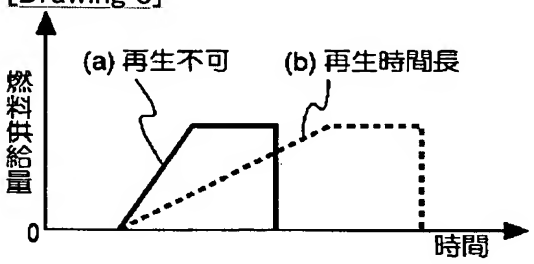
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]

(19)日本国特許庁（JP）　(12)公開特許公報（A）　(11)特許出願公開番号
特開平9－222009
(43)公開日　平成9年(1997)8月26日

甲第 1

(51)Int.Cl.⁶		識別記号	庁内整理番号	F I			技術表示箇所
F01N	3/02	321 ZAB		F01N	3/02	321B ZAB	
	3/20				3/20	H K R	

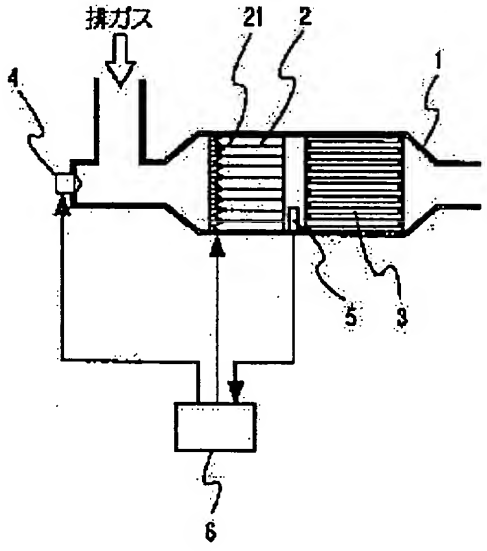
審査請求　未請求　請求項の数4　FD　(全 7 頁)　最終頁に続く

(21)出願番号　特願平8－53913
(22)出願日　平成8年(1996)2月15日

(71)出願人　000004695
株式会社日本自動車部品総合研究所
愛知県西尾市下羽角町岩谷14番地
(72)発明者　小井　良治
愛知県西尾市下羽角町岩谷14番地　株式会社日本自動車部品総合研究所内
(72)発明者　三好　新二
愛知県西尾市下羽角町岩谷14番地　株式会社日本自動車部品総合研究所内
(72)発明者　高木　二郎
愛知県西尾市下羽角町岩谷14番地　株式会社日本自動車部品総合研究所内
(74)代理人　弁理士　伊藤　求馬

(54)【発明の名称】　内燃機関の排気微粒子浄化装置

(57)【要約】
【課題】アイドリング時など、排気温度が特に低い運転条件においても、再生に長時間を要したり、電力供給量を増大させることなく、フィルタの再生を良好に行うことのできる内燃機関の排気微粒子浄化装置を提供する。
【解決手段】内燃機関の排気流路途中に設けられて排気中に含まれる微粒子を捕集する触媒担持フィルタ３の、排気の流れに対して上流側に触媒コンバータ２を設け、該触媒コンバータ２に電気的に発熱して触媒コンバータ２の触媒を部分的に活性化することのできる部分加熱ヒータ２１を付設する。排気温度が触媒活性化温度よりも低い運転条件でフィルタ３の再生を行う場合には、部分加熱ヒータ２１に通電して触媒コンバータ２を部分的に活性化し、さらに燃料噴射弁４にて触媒コンバータ上流の排気流路１中に未燃焼の燃料を供給して、これを活性化した触媒で酸化させる。燃料供給量は、触媒の活性状態が安定するまでは活性化した触媒が活性状態を維持できる程度の少量に制御されるので、装置温度を低下させることがなく、その後、燃料供給量を増加することで活性化領域を全体に広げることができる。



ンバータを有し、該触媒コンバータには排気温度が触媒活性化温度よりも低い運転条件でフィルタの再生を行う時に電気的に発熱して上記触媒コンバータの触媒を部分的に活性化することのできる部分加熱ヒータが付設されている。また、浄化装置は、上記触媒コンバータより上流側の排気流路中に未燃焼の燃料を供給する燃料供給手段と、燃料供給量の制御手段を備え、制御手段は、上記触媒コンバータの触媒活性状態に基づいて、燃料供給量を、触媒の活性状態が安定するまでは活性化した触媒が活性状態を維持できる程度の少量とし、その後、燃料供給量を増加させるように制御するようになしてある（請求項1）。

【００１０】フィルタの再生は、内燃機関が高回転、高負荷の運転条件にあるときのように、排気温度が触媒活性化温度以上の場合には、燃料供給手段によって排気流路中に未燃焼の燃料を供給すれば、燃料が触媒によって酸化されるため、その酸化反応熱によってフィルタ上に堆積した微粒子を加熱、燃焼させることができる。ところが、内燃機関が低回転、低負荷の運転条件にあるときのように、排気温度が触媒活性化温度よりも低い場合には、燃料を供給しても触媒が活性化していないため、燃料が酸化されず、フィルタの再生ができない。

【００１１】このようなとき、本発明請求項１の構成では、触媒担持フィルタ上流側の触媒コンバータに付設される部分加熱ヒータに電力を供給して、ヒータ近傍の触媒を加熱し、触媒コンバータの触媒を部分的に活性化する。部分加熱ヒータの温度が安定したところで、燃料供給手段によって、ヒータ近傍の触媒温度が活性化温度よりも低くならない程度の少量の燃料を供給すると、燃料が部分的に活性化した触媒で酸化され、その反応熱を受けて触媒活性化領域が次第に広がる。ここで、燃料供給量は、一度活性化した触媒が活性状態を維持できる程度の少量に制御されているので、部分加熱ヒータの壁面温度を低下させることなく、活性化領域を徐々に広げて、触媒コンバータからフィルタの一部にまで拡大することができる。

【００１２】触媒の活性状態が安定したところで、燃料供給量を増加させていくと、燃料は広がった触媒活性化領域で酸化され、その反応熱を受けてさらに触媒活性化領域が広がり、最終的にはフィルタ全体の触媒が活性化される。燃料は触媒コンバータとフィルタ全体の触媒で酸化され、この反応熱によってフィルタ上に堆積した微粒子を着火温度以上に昇温し、燃焼させてフィルタを再生することができる。

【００１３】より具体的には、上記触媒コンバータまたは触媒担持フィルタの下流側に排気温度を検出する手段を設け、上記制御手段が、その検出結果に基づいて、触媒コンバータの触媒が活性状態を維持できる燃料供給量および活性状態が安定するまでの時間を算出するように構成すればよい（請求項2）。

【００１４】さらに、上記制御手段が、触媒の活性状態が安定したかどうかを上記検出手段で検出される排気温度が上昇、安定したかどうかで判断し、排気温度の上昇が安定した時点から燃料供給量を増加させるように設定すれば（請求項3）、触媒の活性状態が安定するまでの燃料供給時間をより適切な長さとすることができる。

【００１５】また、上記触媒コンバータは触媒担持部分が、供給される全燃料を燃焼するに十分な長さを有している構成とすることもできる（請求項4）。このとき、供給される燃料が全て触媒コンバータ内で燃焼するので、触媒担持フィルタ前後での温度差を小さくできる。これにより、フィルタ内で燃料を燃焼させる構成に比べ、微粒子の燃え残りを低減・防止でき、また、フィルタ後方での異常高温などによるフィルタ損傷を防止できる利点がある。

【００１６】

【発明の実施の形態】以下、本発明の一実施の形態を図面を参照して説明する。図１において、内燃機関の排気流路１は、途中に大径部を設けてあって、該大径部内に排気の流れに対し上流側から触媒コンバータ２、触媒担持フィルタ３が間隔をおいて配設してある。

【００１７】上記触媒担持フィルタ３は、例えばコージェライト等の多孔質セラミックよりなり、これにγ－アルミナ等をコーティングした上、ＰｔまたはＰｄ－Ｒｈ等の酸化触媒を担持させてなる。該フィルタ３は、排気の流れ方向に多数のセルを有し、これらセルの、排ガス導入側または導出側のいずれかの端部を千鳥格子状に閉鎖した構造となしてある。そして、導入された排ガスが多孔質の隔壁を通してセル間を流通する間にカーボン粒子等の微粒子を捕集するものである。

【００１８】上記触媒コンバータ２は、例えばステンレス鋼等の耐熱性金属箔よりなる帯状の平板と波板を積層した後、棒状の中心電極周りに渦巻き状に巻き付けてなるハニカム構造のメタル担体に、γ－アルミナ等をコーティングした上、ＰｔまたはＰｄ－Ｒｈ等の酸化触媒を担持させて構成される。

【００１９】上記触媒コンバータ２は、その上流側端部に、通電により発熱して触媒を部分的に活性化するための部分加熱ヒータ２１を有している。上記触媒コンバータ２は、メタル担体を構成する平板と波板を、例えばろう付け等によって接合し、巻き重ねられた層間を短絡するようにした接合領域と、平板と波板を互いに絶縁を保持するようにして巻き、電流が渦巻き状に流れるようにした非接合領域とからなり、このうち接合領域では電流が短絡して流れるため電気抵抗が小さく、電気抵抗が大きい非接合領域において集中的に発熱を生じる。従って、部分加熱ヒータ２１を形成する部分が非接合領域となるように上記メタル担体を形成すれば、触媒コンバータ２の一部に容易に部分加熱ヒータ２１を設けることができ、中心電極から外周の環状電極の間に通電すること

【００３３】次に、コントローラ６が排気流量またはエンジン回転数、排気温度から、触媒コンバータ２の触媒活性化領域の壁面温度が、供給した燃料の蒸発潜熱のために触媒活性化温度以下とならない燃料供給量Ｆを算出し、燃料供給を開始する（図５（ａ））。そして、この燃料供給量Ｆの燃料を予め決められた時間Ｔｓだけ燃料供給装置から供給する。これにより触媒コンバータ２の温度が上昇し、さらに多くの燃料を供給しても触媒コンバータ２の温度は触媒活性化温度以上を維持できるようになる。

【００３４】そこで、徐々に予め決められた勾配で燃料供給量を増加させると、触媒コンバータ７の触媒が活性化し、燃料供給量の増加とともに触媒活性化領域が広がって（図５（ｂ））、最終的には、触媒コンバータ７全体の触媒を活性化できる（図５（ｃ））。以後、さらに燃料供給量をそれまでと同じ割合または直ちに排気微粒子の燃焼温度に昇温できる量まで増加させると、触媒コンバータ７内で燃料が酸化され、その反応熱によりフィルタに流入する排気温度を煤の燃焼温度以上に昇温し、フィルタを再生できる。

【００３５】上記構成では、全燃料を燃焼するに十分な長さを有する触媒コンバータ７を設けて、主にこの触媒コンバータ７内で排気を昇温するようにしたので、触媒担持フィルタ前後での温度差を小さくできる。これにより、フィルタ内で燃料を燃焼させる構成に比べ、微粒子の燃え残りを低減・防止でき、また、フィルタ後方での異常高温などによるフィルタ損傷を防止できる利点がある。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態を示す排気微粒子浄化装置の全体概略断面図である。

【図２】第１の実施の形態における燃料供給量の制御方法を説明するための図である。

【図３】本発明の第２の実施の形態における燃料供給量の制御方法を説明するための図である。

【図４】本発明の第３の実施の形態を示す排気微粒子浄化装置の全体概略断面図である。

【図５】第３の実施の形態における燃料供給量の制御方法を説明するための図である。

【図６】従来の排気微粒子浄化装置の全体概略断面図である。

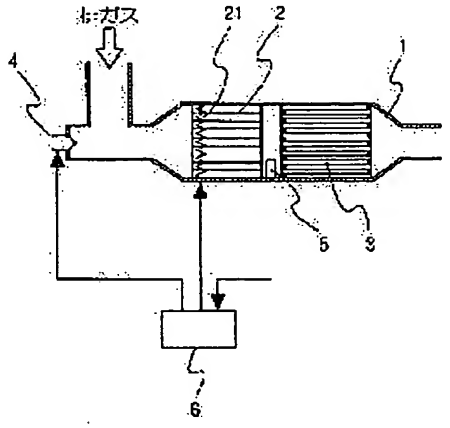
【図７】従来の燃料供給量の制御方法を説明するための図である。

【図８】従来の燃料供給量制御における燃料供給量と時間の関係を示す図である。

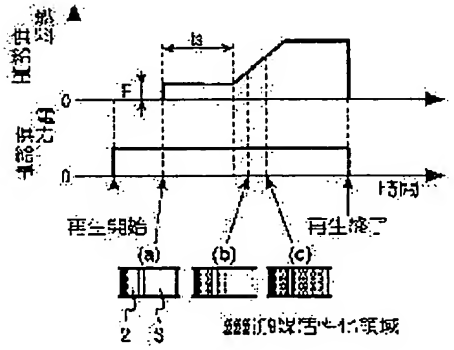
【符号の説明】

１　排気流路
２　触媒コンバータ
２１　部分加熱ヒータ
３　触媒担持フィルタ
４　燃料噴射弁（燃料供給手段）
５　温度センサ（検出手段）
６　コントローラ
７　触媒コンバータ

【図１】



【図２】



フロントページの続き

(51)Int.Cl.6	識別記号	庁内整理番号	F I		技術表示箇所
F02D 43/00	301		F02D 43/00	301T	